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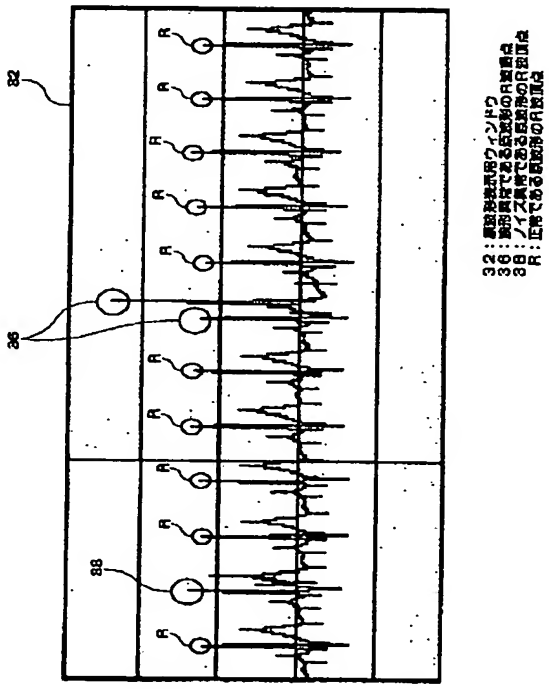
(54)【発明の名称】　状態量表示装置および状態量表示方法

(57)【要約】
【課題】　観察対象の状態等をリアルタイムで容易に把握することのできる状態量表示装置および状態量表示方法を提供する。
【解決手段】　原波形表示用ウィンドウ３２に心電図の原波形を表示する際、原波形が正常である場合には、正常である原波形のＲ波頂点Ｒを赤色（正常色）で表示する。原波形が波形異常である場合には、異常である原波形のＲ波頂点３６を黄色（波形異常色）で表示する。原波形がノイズ異常である場合には、異常である原波形のＲ波頂点３８を白色（ノイズ異常色）で表示する。したがって、ノイズ異常と波形異常とをリアルタイムで容易に視覚的に識別することができる。このため、実験動物など生体の体動によるノイズと、心筋の異常等による波形異常とをリアルタイムで容易に視覚的に確認することができる。



2001-8914

Japanese Laid-open Patent Application (KOKAI) 2001-8914

【TITLE OF THE INVENTION】 A Display Device of Quantity of State and A Method of Displaying Quantity of State

【CLAIM】

【Claim 1】 A display device of quantity of state comprising:

acquisition means for acquiring state quantity data corresponding to a state of a living body, the state quantity data representing as a function of time;

display means; and

control means for controlling display of a display relating to the state of a living body on the display means in accordance with the acquired state quantity data by the acquisition means ;

wherein the control means discriminates a predetermined remarked portion out of the state quantity data substantially real time basis and performs display corresponding to the remarked portion in a different form from the display corresponding to other portion using a graph having a time-axis.

【Claim 2】 A display device of quantity of state comprising:

acquisition means for acquiring state quantity data corresponding to a state of a living body, the state quantity data representing as a function of time;

display means; and

control means for controlling display of a display relating to the state of a living body on the display means in accordance with the acquired state quantity data by the acquisition means ;

wherein the control means controls to extract data on the quantity of characteristics representing the state quantity data based on the state

quantity data in substantially real time basis and to perform the display the characteristic quantity data including the past history using a graph having a time-axis.

【Claim 3】 A display device of quantity of state comprising:

acquisition means for acquiring state quantity data corresponding to a state of a living body, the state quantity data representing as a function of time;

display means; and

control means for controlling display of a display relating to the state of a living body on the display means in accordance with the acquired state quantity data by the acquisition means ;

wherein the control means controls to perform the display about the conditions for acquiring the quantity relevant to the quantity data of conditions or the quantity relevant to the quantity data of conditions in substantially real time basis.

【Claim 4】 A program storage medium for storing a program executed by a computer comprising acquisition means for acquiring state quantity data corresponding to a state of a living body, the state quantity data representing as a function of time and display means, the program performing process of controlling display of state quantity data corresponding to a state of a living body in accordance with state quantity data acquired by the acquisition means for acquiring state quantity data on the display means,

wherein the program storage medium stores a program of performing process of discriminating a predetermined remarked portion out of the state quantity data substantially real time basis and performing display

corresponding to the remarked portion in a different form from the display corresponding to other portion using a graph having a time-axis by the computer.

【Claim 5】 A program storage medium storing the program of claim 4, wherein the remarked portion is an abnormal portion by a sudden cause.

【Claim 6】 A program storage medium storing the program of claim 5, wherein the process of controlling display of state quantity data corresponding to a state of a living body has the processes of distinguishing an abnormal portion by a sudden cause which considers a noise as a cause based on the extracted characteristic data, another abnormal portion which does not consider a noise as a cause and a normal portion, and controlling to perform the display corresponding to the each portion by the different form from each other, while extracting data on the quantity of characteristics representing state quantity data based on the state quantity data.

【Claim 7】 A program storage medium for storing a program executed by a computer comprising acquisition means for acquiring state quantity data corresponding to a state of a living body, the state quantity data representing as a function of time and display means, the program performing process of controlling display of state quantity data corresponding to a state of a living body in accordance with state quantity data acquired by the acquisition means for acquiring state quantity data on the display means,

wherein the program storage medium stores a program of performing process of controlling to extract data on the quantity of characteristics

representing state quantity data based on the state quantity data in substantially real time basis and to perform the display the characteristic quantity data including the past history using a graph having a time-axis by the computer.

【Claim 8】 A program storage medium storing the program of claim 7, wherein the process of displaying characteristic quantity data including the past history is a process of discriminating and eliminating abnormal portion by a sudden cause out of the characteristic quantity data, while displaying the characteristic quantity data after the elimination of the abnormal portion.

【Claim 9】 A program storage medium storing the program of claims 7 through 8, wherein the process of displaying characteristic quantity data including the past history is a process of controlling the display of a plurality of graphs having time-axis of different scales on the same display screen simultaneously substantially.

【Claim 10】 A program storage medium storing the program of claim 9, wherein the process controlled to perform the display relevant to the state of the living body 10 is a process of displaying the reaction of prescribing both an evaluation medicine set as the object of evaluation and a reactant medicine of checking the effect of the evaluation medicine as change of the quantity data, and wherein the process of displaying characteristic quantity data including the past history is a process of controlling the display of a plurality of graphs one graph including the point at which an evaluation

medicine is prescribed and the other graph containing the point at which a reactant medicine is added and having an enlarged time-axis than that of the graph including the point at which an evaluation medicine is prescribed on the same display screen simultaneously substantially.

【Claim 11】 A program storage medium for storing a program executed by a computer comprising acquisition means for acquiring state quantity data corresponding to a state of a living body, the state quantity data representing as a function of time and display means, the program performing process of controlling display of state quantity data corresponding to a state of a living body in accordance with state quantity data acquired by the acquisition means for acquiring state quantity data on the display means,

wherein the program storage medium stores a program of performing process of controlling to perform the display about the conditions for acquiring the quantity relevant to the quantity data of conditions or the quantity relevant to the quantity data of conditions by the computer.

【Claim 12】 A program storage medium storing the program of claim 11, wherein the process controlled to perform the display about the quantity relevant to the quantity data of conditions is a process in which the statistics amount of the quantity data of the characteristics within a predetermined period is computed while extracting the quantity data of the characteristic which expresses the characteristic of the quantity data of states based on the quantity data of conditions, and controlling to perform the display relevant to the amount of statistics.

【Claim 13】 A program storage medium storing the program of claim 12, wherein the statistics is one of or both of the maximum and the minimum value of the characteristic data within a predetermined period.

【Claim 14】 A program storage medium storing the program of claims 12 through 13, wherein the process controlled to perform the display relevant to the statistics is a process of controlling the display of the statistics including the past history.

【Claim 15】 A program storage medium storing the program of claims 12 through 14, wherein the beginning of a predetermined period is set at when influence from the outside is performed to a living body.

【Claim 16】 A program storage medium storing the program of claim15, wherein the influence performed from the outside is a procedure of medicating the evaluation medicine to the living body.

【Claim 17】 A program storage medium storing the program of claim 15, wherein the influence performed from the outside is a procedure of medicating a reactant medicine for checking the effect of an evaluation medicine to a living body.

【Claim 18】 A program storage medium storing the program of claim 17, wherein the end of the predetermined period is set up at a predetermined time.

【Claim 19】 A program storage medium storing any one of the programs of claims 12 through 17, wherein one of the beginning of the predetermined period and the end of the predetermined period or both the beginning and the end can arbitrary be set substantially real time when the predetermined period is set.

【Claim 20】 A program storage medium storing any one of the programs of claims 4 through 19, wherein the state quantity data corresponding to the state of the living body is cardiogram data corresponding to the state of the living body.

【Claim 21】 A method of displaying quantity of state, comprising the steps of:

acquiring state quantity data corresponding to quantity of state, data corresponding to an object to be observed the state quantity data representing as a function of time; and controlling display of a display relating to the state of the object to be observed in accordance with the acquired state quantity data ;

wherein the process is controlled so that a predetermined remarked portion out of the state quantity data substantially is discriminated real time and is performed display corresponding to the remarked portion in a different form from the display corresponding to other portion using a graph having a time-axis.

【Claim 22】 A method of displaying quantity of state, comprising the steps of:

acquiring state quantity data corresponding to quantity of state, data corresponding to an object to be observed the state quantity data representing as a function of time; and controlling display of a display relating to the state of the object to be observed in accordance with the acquired state quantity data ;

wherein the process is controlled so that data on the quantity of characteristics representing the state quantity data is extracted based on the state quantity data in substantially real time basis and to perform the display the characteristic quantity data including the past history using a graph having a time-axis.

【Claim 23】 A method of displaying quantity of state, comprising the steps of:

acquiring state quantity data corresponding to quantity of state, data corresponding to an object to be observed the state quantity data representing as a function of time; and controlling display of a display relating to the state of the object to be observed in accordance with the acquired state quantity data;

wherein the process is controlled so that the display about the conditions for acquiring the quantity relevant to the quantity data of conditions or the quantity relevant to the quantity data of conditions is performed substantially real time.

【DETAILED DESCRIPTION OF THE INVENTION】

【0001】

【Field of the invention】 This invention relates to a display device of quantity of state and a method of displaying quantity of state, more specifically to a technology of displaying processed data corresponding to the state for observation such as a living body.

【0002】

【Conventional art】 Electrocardiograms are used for the surveillance of patients and evaluation of the medication effect of medicines. For example, the condition of disease of a circulatory organ system and the influence on a circulatory organ system when laboratory animals are medicated with an evaluation medicine can be monitored using an electrocardiogram. In this case, the electrocardiograph and the like complex is displayed on an electrocardiogram monitor and an observer can know change of the heart function, and change of the heart function by medicine medication by seeing the electrocardiogram monitor.

【0003】

【Problem to be solved】 The conventional electrocardiogram monitor, however, has the following problem(s) to be solved. If the monitored patient moves during the surveillance, such movement will appear as a change(s) on an electrocardiogram, but such change(s) is dealt with as a noise(s), during the monitor of the abnormalities of the heart function. However, it is not easy to judge whether the noise(s) cause causes such change(s) or not. Hence, in the conventional electrocardiogram monitor, there are many cases that the noise was the cause but it was judged that the heart function was abnormal and warning is made. If this problem is left as it is, neither the abnormalities of the heart function nor change thereof can be correctly recognized on real time.

【0004】 Conventionally, recognized values (for example, myocardial contraction periods) extracted from cardiograms are displayed to evaluate heart function, but this just display currently recognized values only. However, it is necessary to understand how the recognition value has changed with progress of time, not just the current recognized values, in order to diagnose the abnormalities of the heart function and its change. For this reason, conventionally neither the abnormalities of the heart function nor change was able to be recognized correctly on real time.

【0005】 When conducting an experiment which evaluates the effect of medicine medication using an cardiogram monitor, a reactant medicine for getting to know the effect of an evaluation medicine may be compounded and prescribed for a patient with the medicine used as the candidate for evaluation. Management of the grant timing of these medicines, record of medication, record of the effect of medication and so on, however, were performed using a stopwatch or a experiment note. For this reason, when simultaneous experiment is conducted to two or more laboratory animals or a complex experiment is performed, the artificial mistake tended to occur. In other words, it was difficult to recognize the states of the experiment including the state of laboratory animals on real time.

【0006】 This invention provides a display device of quantity of state and a method of displaying quantity of state which solve the problems incorporated in the conventional electrocardiogram monitor and that can recognize the object to be monitored easily and correctly on real time.

【0007】

【Means for solving the problem】 In accordance with the quantity state display device of claim1, the program storage medium storing the program of

claim 4 and the method of displaying quantity state of claim 21, the process is controlled so that a predetermined remarked portion out of the state quantity data substantially is discriminated real time and is performed display corresponding to the remarked portion in a different form from the display corresponding to other portion using a graph having a time-axis

【0008】 In this way, a predetermined remarked portion related to abnormalities and variation of the object to be observed such as a living body, or, the predetermined remarked portion which does not related to such object can easily be recognized visually in a real time basis. Consequently, the abnormalities and variation of the object to be observed can easily be recognized real time.

【0009】 In accordance with the program storage medium storing the program of claim 5, the remarked portion is an abnormal portion by a sudden cause. Consequently, the abnormal portion by a sudden cause out of the state quantity data can easily be recognized in real time basis visually.

【0010】 In accordance with the program storage medium storing the program of claim 5, the process of controlling display of state quantity data corresponding to a state of a living body has the processes of distinguishing an abnormal portion by a sudden cause which considers a noise as a cause based on the extracted characteristic data, another abnormal portion which does not consider a noise as a cause and a normal portion, and controlling to perform the display corresponding to the each portion by the different form from each other, while extracting data on the quantity of characteristics representing state quantity data based on the state quantity data. Consequently, an abnormal portion by a sudden cause which considers a noise as a cause, another abnormal portion which does not consider a noise

as a cause, and a normal portion .can easily be distinguished visually real time.

【0011】 In accordance with the quantity state display device of claim2, the program storage medium storing the program of claim 7 and the method of displaying quantity state of claim 22, the process is controlled so that data on the quantity of characteristics representing the state quantity data is extracted based on the state quantity data in substantially real time basis and to perform the display the characteristic quantity data including the past history using a graph having a time-axis.

【0012】 Hence, characteristics of the quantity state data can easily be distinguished visually real time. Consequently, abnormality and variation and so on of the object to be observed such as a living body can easily be recognized visually real time.

【0013】 In accordance with the program storage medium storing the program of claim 8, the process of displaying characteristic quantity data including the past history is a process of discriminating and eliminating abnormal portion by a sudden cause out of the characteristic quantity data, while displaying the characteristic quantity data after the elimination of the abnormal portion.

【0014】 Consequently, the characteristic of the quantity state data can further be visually recognized by just displaying the characteristic data eliminating the abnormal portion by sudden cause.

【0015】 In accordance with the program storage medium storing the program of claim 9, the process of displaying characteristic quantity data including the past history is a process of controlling the display of a plurality of graphs having time-axis of different scales on the same display screen

simultaneously substantially.

[0016] In this way, depending on the kind and the purpose of data, a graphical representation can be carried out using the scale of a time-axis which was most suitable, respectively. Consequently, the characteristic of the quantity state data can still further be visually recognized.

[0017] In accordance with the program storage medium storing the program of claim 10, the process controlled to perform the display relevant to the state of the living body 10 is a process of displaying the reaction of prescribing both an evaluation medicine set as the object of evaluation and a reactant medicine of checking the effect of the evaluation medicine as change of the quantity data, and the process of displaying characteristic quantity data including the past history is a process of controlling the display of a plurality of graphs one graph including the point at which an evaluation medicine is prescribed and the other graph containing the point at which a reactant medicine is added and having an enlarged time-axis than that of the graph including the point at which an evaluation medicine is prescribed on the same display screen simultaneously substantially.

[0018] In this way, the graphic display can be carried out using scales of respective optimal time-axis of both the influences affect on laboratory animals medicating the evaluation medicine by which a reaction continues over comparatively long time and the influences of the medicated reactive medicine by which a reaction disappears in comparatively short time. Consequently, the timing and so on for the upcoming medication of the reactive medicine can be determined easily.

[0019] In accordance with the quantity state display device of claim 3, the program storage medium storing the program of claim 11 and the method

of displaying quantity state of claim 23, the process is controlled so that the display about the conditions for acquiring the quantity relevant to the quantity data of conditions or the quantity relevant to the quantity data of conditions is performed substantially real time.

【0020】 In this way, the conditions for acquiring the quantity relevant to the quantity data of conditions or the quantity relevant to the quantity data of conditions can easily be checked real time. Consequently, experimental circumstances including the situation of laboratory animals can easily be recognized real time.

【0021】 In accordance with the program storage medium storing the program of claim 12, the process controlled to perform the display about the quantity relevant to the quantity data of conditions is a process in which the statistics amount of the quantity data of the characteristics within a predetermined period is computed while extracting the quantity data of the characteristic which expresses the characteristic of the quantity data of states based on the quantity data of conditions, and controlling to perform the display relevant to the amount of statistics.

【0022】 In this way, the statistics amount of the quantity data of the characteristics can easily be checked in a statistical viewpoint by performing display of not only the characteristic data but also the display relevant to the amount of statistics in real time. Consequently, abnormality and variation and so on of the object to be observed such as a living body can further easily be recognized real time.

【0023】 In accordance with the program storage medium storing the program of claim 13, the statistics is one of or both of the maximum and the minimum value of the characteristic data within a predetermined period.

【0024】 Consequently, characteristics of the variation of the characteristic data within the predetermined period can easily be recognized real time.

【0025】 In accordance with the program storage medium storing the program of claim 14, the process controlled to perform the display relevant to the statistics is a process of controlling the display of the statistics including the past history.

【0026】 Consequently, abnormality and variation and so on of the object to be observed such as a living body can still further easily be recognized real time by knowing the statistics including the past history.

【0027】 In accordance with the program storage medium storing the program of claim 15, the beginning of a predetermined period is set at when influence from the outside is performed to a living body.

【0028】 In this way, the influence from the outside can easily be evaluated real time in a statistic view point by conducting a statistical processing in which the beginning of a predetermined period is set at when influence from the outside is performed to a living body. Consequently, the influence on the object to be observed such as a living body can easily be evaluated real time.

【0029】 In accordance with the program storage medium storing the program of claim 16, the influence performed from the outside is a procedure of medicating the evaluation medicine to the living body.

【0030】 In this way, the influence from the medication of the evaluation medicine can easily be evaluated by conducting a statistical processing in which the beginning of a predetermined period is set at when the evaluation medicine is medicated to a living body. Consequently, the influence from the medication of the evaluation medicine to the object to be observed such as a living body can easily be evaluated real time.

【0031】 In accordance with the program storage medium storing the program of claim 17, the influence performed from the outside is a procedure of medicating a reactant medicine for checking the effect of an evaluation medicine to a living body.

【0032】 In this way, the effect of medication the evaluation medicine actualized by medication of a reactant medicine can further easily be evaluated from a statistical viewpoint. by conducting a statistical processing in which the beginning of the medication is set at when the reactant medicine is medicated to a living body.

【0033】 In accordance with the program storage medium storing the program of claim 18, the end of the predetermined period is set up at a predetermined time.

【0034】 In this way, a statistical processing can be executed automatically by conducting the statistical processing using a time period from the medication of the reactant medicine to a predetermined period as an unit. Consequently, the effect of an evaluation medicine can easily be recognized on real time in accordance with medication of the reactant medicine carried out one after another.

【0035】 In accordance with the program storage medium storing the program of claim 19,one of the beginning of the predetermined period and the end of the predetermined period or both the beginning and the end can arbitrary be set substantially real time when the predetermined period is set.

【0036】 In this way, the time period for calculating the statistics amount of the quantity data of the characteristics can arbitrary be set real time. The statistics processing can be made to be able to start, or it can be made to end whenever it is thought that it is suitable looking at transition of the amount

data of the features.

【0037】 In accordance with the program storage medium storing the program of claim 20, the state quantity data corresponding to the state of the living body is cardiogram data corresponding to the state of the living body.

【0038】 Consequently, condition-of-disease judging of the circulatory organ system as which prompt processing is required, and influence which it has on a circulatory organ system when laboratory animals are medicated with an evaluation medicine can easily be evaluated correctly in a real time basis.

【0039】

【Embodiment of the invention】 [1. structure of a device] Fig. 1 shows an example of a display device 70 of quantity of state. The display device 70 comprises state quantity data acquiring means 2, control means 4 and display means 6. The state quantity data acquiring means 2 acquires data represents state quantity. The state quantity data corresponds to a state of a living body 10 which is a candidate for observation and represent function of time.

【0040】 The control means 4 controls the display means 6 to carry out a display related to the state of the living body 10 in accordance with state quantity data acquired by the state quantity data acquiring means 2. Further details of control means 4 will be described hereunder.

【0041】 The control means 4 control to discriminate predetermined remarked portions out of state quantity data substantially real time basis and to perform the display corresponding to the remarked portions by a different form from the display corresponding to other portions using a graph having a time-axis. In this embodiment, the remarked portions are abnormal portions by a sudden cause.

【0042】 In more detail, the process controlled to perform the display relevant to the state of the living body 10 has the following processes.

While extracting data on the quantity of characteristics representing state quantity data based on the state quantity data, an abnormal portion by a sudden cause which considers a noise as a cause based on the extracted characteristic data, another abnormal portion which does not consider a noise as a cause, and a normal portion are distinguished. In addition, the process still controls to perform the display corresponding to the each portion by the different form from each other.

【0043】 The control means 4 controls to extract data on the quantity of characteristics representing state quantity data based on the state quantity data in substantially real time basis and to perform the display the characteristic quantity data including the past history using a graph having a time-axis.

【0044】 In far more detail, the process of displaying characteristic quantity data including the past history is a process of discriminating and eliminating abnormal portion by a sudden cause out of the characteristic quantity data, while displaying the characteristic quantity data after the elimination of the abnormal portion.

【0045】 In still far more detail, the process of displaying characteristic quantity data including the past history is a process of controlling the display of a plurality of graphs having time-axis of different scales on the same display screen simultaneously substantially.

【0046】 In this embodiment, the process controlled to perform the display relevant to the state of the living body 10 is a process of displaying the reaction of prescribing both an evaluation medicine set as the object of

evaluation and a reactant medicine of checking the effect of the evaluation medicine as change of the quantity data. The process of displaying characteristic quantity data including the past history is a process of controlling the display of a plurality of graphs one graph including the point at which an evaluation medicine is prescribed and the other graph containing the point at which a reactant medicine is added and having an enlarged time-axis than that of the graph including the point at which an evaluation medicine is prescribed on the same display screen simultaneously substantially.

【0047】 The control means 4 controls to perform the display about the conditions for acquiring the quantity relevant to the quantity data of conditions or the quantity relevant to the quantity data of conditions.

【0048】 In far more detail, the process controlled to perform the display about the quantity relevant to the quantity data of conditions is a process in which the amount of statistics of the quantity data of the features within a predetermined period is computed while extracting the quantity data of the characteristic which expresses the characteristic of the quantity data of states based on the quantity data of conditions, and controlling to perform the display relevant to the amount of statistics.

【0049】 In this embodiment, the statistics is one of or both of the maximum and the minimum value of the characteristic data within a predetermined period. The process controlled to perform the display relevant to the statistics is a process of controlling the display of the statistics including the past history.

【0050】 In this embodiment, the beginning of a predetermined period is set at when influence from the outside is performed to a living body 10. In

far more detail, influence performed from the outside has the procedure such as a procedure of medicating the evaluation medicine which is defined as the object of evaluation to a living body 10 or a procedure of medicating or a procedure medicating a reactant medicine for checking the effect of the evaluation medicine to a living body 10. The beginning of a predetermined period can also be substantially set up arbitrarily on real time.

【0051】 In this embodiment, the end of a predetermined period is set up at a predetermined time. In addition, the end of the predetermined may also be set up substantially real time basis.

【 0052 】 In the embodiment, the quantity data of conditions corresponding to the is cardio graphic data responding to the state of the heart of the live body 10

【 0053 】 [2. Hardware structure] Fig. 2 is a diagram showing an exemplary hardware structure of the quantity state display device 70 depicted in Fig. 1 in which each of the functions thereof are realized with CPU 72. The display device 70 is a computer comprises a CPU 74 serves as a control part and being connected with a bus 72, a RAM (random access memory) serves as a temporary memory device, a hard disk drive 78 serves as a storage medium driving device, a flexible disk drive 80 and a CD-ROM drive 88, a display 82 serve as display means 6, a keyboard 84 serves as an input device, a mouse 86 and a foot switch 104, a cardiograph sensor 102.

【0054】 The program for controlling the display is installed on a hard disk 90 serves as a storage medium being built-in the hard disk drive 78 from a CD-ROM 94 inserted in the CD-ROM drive 88 and a flexible disk 92 inserted in the flexible disk drive 80, and the program is load on the RAM 76.

【0055】 Data under processing and that after processing is temporary

written onto the RAM 76, then stored the flexible disk 92 and /or hard disk 90. When the CD-ROM 94 is writable one, such data may be stored on the CD-ROM 94.

[0056] In other words, the RAM 76, the CD-ROM 94, the flexible disk 92 and /or the hard disk 90 correspond a computer readable program storage medium recording a program for the display control described in the above and/or a computer readable data storage medium storing data.

[0057] The program installed on the hard disk 90 is loaded on the RAM 76 and such program is run on the CPU 74. On the display 82, processing results and the like are displayed.

[0058] Commands or the like are input with the keyboard 84 and/or the mouse 86. The time of prescribing an evaluation medicine for a live body 10 serves as a laboratory animal 106 and that of a reactant medicine for the laboratory animal 106 can be inputted using the foot switch 104.

[0059] The cardiogram sensor 102 is arranged on the laboratory animal 106, and original data of cardiogram serves as quantity state data is acquired via an input interface 100. The input interface 100 comprises a cardiograph amplifier, an A/D (analog/digital) converter, a driver and so on. Both the cardiogram sensor 102 and the input interface 100 correspond to the state quantity data acquiring means 2 depicted in Fig. 2.

[0060] The process for executing programs and the like recorded on a storage medium with a computer is not limited. For example, such process may take step of installing a program and the like on the hard disk 90 from the CD-ROM 94 and the flexible disk 92, and then executing the program and the like. The program and the like recorded on the CD-ROM 94 and the flexible disk 92 may also be executed directly through the CD-ROM drive 88

or the flexible disk drive 80.

【0061】 Programs and data executable by computers include not only ones directly executable by just installing them but also include ones once they change into another form (for example, ones under data compression is decompressed and then executed), and further include ones executed combining other module portions.

【0062】 In the above description, the RAM 76, the CD-ROM94, the flexible disk 92 and/or the hard disk 90 are used as data storage medium, but other data storage medium mentioned the above can be used.

【0063】 Besides DVDs (digital video disc) , MO discs (magneto-optical disc) , MTs (magnetic tapes) or the like, carrier waves and communication cables and the like correspond to the data storage medium when communication of the program and the like are carried out via a wire or a radio communication device.

【0064】 [2. Software structure] Fig. 3 is a diagram illustrating an example of software structure of the display device 70 shown in Fig. 1 realizing its functions with the CPU 74 (see Fig. 2). In this embodiment, the program (software) comprises a plurality of modules each of the modules is multi-task controlled.

【0065】 Moreover each of the modules is made as an object for every measurement parameters (for example, cardiogram, blood pressure, blood current, left ventricular pressure, respiratory volume, so on), and each of the measurement parameters are set capable of corresponding to a plurality of laboratory animals (for example, dogs, monkeys, rats so on).

【 0066 】 Consequently, the CPU 74 can measure a plurality of measurement parameters at the same time by referring both a measurement

parameter database (not shown) storing information about measuring conditions so on for each of measurement parameters and database for laboratory animals (not shown) storing information about measuring conditions so on for each of laboratory animals. For the convenience in description, a case in which one measurement parameter (cardiogram) for a laboratory animal 106 being measured will be described in this embodiment.

【0067】 There are a recognition module 10, an original waveform preservation module 12, an original waveform display module 14, a recognized data management /display module for medication experiment 16, a recognized data management /display module for reactant experiment 18, a digital data display module 20, a recognized data preservation module 22. These modules correspond to the control means 4 shown in Fig.1.

【0068】 The recognition module 10 extracts recognized value data serving as characteristic quantity data from the original waveform data, and acquires abnormality judging data by recognizing one of a sudden abnormal part caused by noises, another sudden abnormal part not caused by noises and normal part based on the extracted characteristic quantity data.

【0069】 The original waveform preservation module 12 saves original waveforms on the hard disk 90 in accordance with the original waveform data, the recognized value data and the abnormality judging data acquire by the recognition module 10.

【0070】 The original waveform display module 14 displays the original waveforms in graphical representation based on the original waveform data, the recognized value data and the abnormality judging data (see Fig. 11, an original waveforms display window 32).

【0071】 The recognized data management /display module for medication

experiment 16 displays on the display 82 the recognized data for medication experiment in graphical representation based on the recognized value data and the abnormality judging data (see Fig. 11, a recognized value display window for medication experiment 28).

【0072】 The recognized data management /display module for reactant experiment 18 displays on the display 82 the recognized data for reactant experiment in graphical representation based on the recognized value data and the abnormality judging data (see Fig. 11, a recognized value display window for reactant experiment 30).

【0073】 The digital data display module 20 displays digital data on the display 82 based on the recognized value data and the abnormality judging data (see Fig. 11, a digital data display window 34).

【0074】 The recognized data preservation module 22 saves the recognized value data in the hard disk 90 based on the recognized value data and the abnormality judging data.

【0075】 Figs. 4 through 10 are flow charts respectively showing processing steps of the recognition module 10, the original waveform preservation module 12, the original waveform display module 14, the recognized data management /display module for medication experiment 16, the recognized data management /display module for reactant experiment 18, the digital data display module 20 and the recognized data preservation module 22.

【0076】 Fig. 11 is a graph showing display images 24 of the display 82. The display images 24 comprises the original waveforms display window 32, the recognized value display window for medication experiment 28, the recognized value display window for reactant experiment 30 and the digital

data display window 34.

【0077】 Fig. 12 is a partial enlarged view of the original waveforms display window 32. Fig. 13 is a further partial enlarged view of the original waveforms display window 32 shown in Fig. 12. Fig. 14 is an enlarged view of the digital data display window 34. Fig. 15 is a partial enlarged view of the recognized value display window for medication experiment 28. Fig. 16 is a partial enlarged view of the recognized value display window for reactant experiment 30.

【0078】 At first, process carried out in the recognition module 10 will be described in accordance with Fig. 4. The CPU 74 acquires signals from the cardiograph sensors 102 via the input interface 100 (step S100). The CPU 74 keeps acquiring the signals until all the data for 1 complete waveform is input (step S2). Here, the data for 1 complete waveform is referred to the data from a starting point Pb of P wave to the upcoming starting point Pb as shown in Fig. 13.

【0079】 Once data for 1 complete waveform is input, the CPU 74 performs a wave recognition about the data for 1 complete waveform being acquired (step S3). In step S3, a starting point Pb of P wave, a top point Pa of P wave, a starting point Q of Q wave, a top point R of R wave, a top point S of S wave, a top point Ta of T wave, an ending point Te of T wave as shown in Fig. 13. The values of these points (voltage value) and observation time period (lapsed time from an experiment start) correspond to each of recognized value data

【0080】 In this embodiment, the CPU 74 respectively calculates a time duration QT between the starting point Q of Q wave and the ending point Te of T wave, a time duration PR between the starting point Pb of P wave and

the top point R of R wave, a time duration PR between top points R of R wave of two continuous waveforms. These time durations correspond to the recognized value data as well.

【0081】 Next the CPU 74 judges abnormality on the data of recognized value being acquired (step S4).

【0082 】 There is no limitation on the abnormality judgment, but it may be preferable to judge abnormality on the data for 1 complete waveform caused by noises (for example, collapse of waveform, sudden abnormality caused by noises), abnormality on waveform itself (for example, contraction of heart muscle out of a term, sudden abnormality not caused by noises), and normality. Resulting data of the judgment on abnormality is referred to as abnormality judgment data.

【0083】 The CPU 74 outputs the recognized value data obtained in the previous two steps and the abnormality judgment data (step S5). The process returns to step S1 and repeats the same processes.

【0084】 Next, process carried out in the original waveform preservation module 12 will be described in accordance with Fig. 5. The CPU 74 waits for an original waveform preservation command event (step S11), once the command event is generated, it acquires original waveform data of cardiogram for 1 waveform (step S12). This embodiment configured to generate an original waveform preservation command event once a preservation button 26 on the display images 24 (see Fig. 11) is clocked.

【0085】 The CPU 24 stores the acquired original waveform data of cardiogram for 1 waveform into a preservation area (not shown) corresponding to the current number of command (current waveforms) of an original waveform preservation area in a currently measured measurement

channel storage area (in this embodiment, a cardiogram storage area) arranged in the hardware 90.

【0086】 Subsequently, the CPU 74 acquires the recognized value data and the abnormality judgment data (recognized value data and abnormality judgment data corresponding to the original waveform data of cardiogram for 1 waveform acquired in step S12) (step S14) and saves these data into a preservation area (not shown) corresponding to the current waveform of an original waveform recognized value preservation area arranged in the hardware 90. Consequently, the original waveform data stored in step S13, and both the recognized value data and abnormality judgment data corresponding to the original waveform data are correspondingly stored.

【0087】 The generation of whether or not the original waveform preservation period has passed (step S16). If the preservation period has not passed, the process returns to step S12 and process for storing original waveform data for upcoming 1 waveform is carried out. If the preservation period has passed, on the other hand, the process returns to step S11 and waits for the generation of an original waveform preservation command event.

【0088】 Although, this embodiment is configured so as to predetermine the original waveform preservation period, determination method of the original waveform preservation period is not limited to that way. For example, this embodiment mat be configured so as to stop the original waveform preservation command by clicking again the preservation button during the execution of the command.

【0089】 As described in the above, only the desired original waveform data can selectively be saved by configuring this embodiment to save the

original waveform data so that it may wait for the original waveform preservation command event. In this way, it is preferred when there is not much storage capacity left. Alternatively when there is much storage capacity left, all the original waveform data during the experiment may be stored.

【0090】 Subsequently, process carried out in the original waveform display module 14 will be described in accordance with Figs. 6A, 6B. As shown in Fig. 6A, the CPU 74 generates the original waveforms display window 32 (see Fig. 11) (step S21).

【0091】 The vertical scale on the original waveforms display window 32 is set so as to be an optimal scale corresponding to measurement parameters (cardiograms in this embodiment). The horizontal scale on the original waveforms display window 32 is set so as to be an optimal scale corresponding to measurement parameters (cardiograms in this embodiment) as well.

【0092】 The CPU 74 acquires original waveform data of cardiogram for 1 waveform (step S22) and displays the original waveforms in graphical representation on the original waveforms display window 32 based on the acquired original waveform data (step S23). The CPU 74 repeats steps S22 to S23.

【0093】 On the other hand, the CPU 74 acquires both the recognized value data and the abnormality judgment data the for 1 waveform serving as output of the recognition module 10 as shown in Fig. 6B (step S32) and distinguishes the kind of the abnormality judgment data (step S32).

【0094】 When the abnormality judgment data indicates "normal", the

original waveform(s) corresponding to each of the recognized value data is displayed in respective colors which represent "normal". As enlarged in Fig. 13, the starting point Pb of P wave, the top point Pa of P wave, the starting point Q of Q wave, the top point R of R wave, the top point S of S wave, the top point Ta of T wave and the ending point Te of T wave are respectively displayed as dark red, khaki, white, red, yellow, light purple and purple on the original waveforms display window 32.

[0095] When the abnormality judgment data indicates "abnormality in waveform", a part of or the entire original waveform(s) is displayed in colors which represent "abnormality in waveform". In this embodiment, when a part of the original waveform(s) is an abnormal waveform, the top point 36 of R wave of the abnormal original waveform is displayed in yellow (the color illustrates abnormality) as shown in Fig. 12.

[0096] A part of the abnormal original waveform corresponding to the part related to abnormal recognized value data (for example, the starting point Q of Q wave) may be displayed in colors representing "abnormal" differ from the normal colors. Alternatively, the entire 1 original waveform may be displayed in the abnormal colors.

[0097] When the abnormality judgment data indicates "abnormality caused by noises", a part or the entire of the original waveform displayed in colors representing abnormality caused by noises. In this embodiment, when the original waveform(s) is an abnormal waveform by noises, the top point 38 of R wave of the abnormal original waveform is displayed in white (the color illustrates abnormality caused by noises) as shown in Fig. 12.

[0098] A part of the abnormal original waveform corresponding to the part related to abnormal recognized value data (for example, the starting

point Q of Q wave) may be displayed in colors representing "abnormality caused by noises" differ from the normal colors. Alternatively, the entire 1 original waveform may be displayed in a color illustrates abnormality caused by noises.

[0099] Once the display of the abnormality judgment data is completed, the process returns to step S31 and carries out display of abnormality judgment data for upcoming entire 1 original waveform.

[0100] Hence, in this embodiment, the abnormality caused by noises and the abnormality in waveform can easily be distinguished visually in real time basis. Consequently, the difference between noises caused by movement of living body such as laboratory animals and the abnormality in waveform can easily be distinguished visually in real time basis.

[0101] Although, the "abnormality in waveform" and the "abnormality caused by noises " are displayed in different colors in this embodiment, both can be displayed in the same color if it is not necessary to distinguish these displays.

[0102] This embodiment is configured so as to distinguish abnormal part and normal part in the original waveform by varying color of the original waveform, but the present invention is not limited to that way. For example, abnormal part and normal part may also be distinguished by varying width of a line forming the waveform. In addition, these parts may also be distinguished by performing blink indication of the abnormal part.

[0103] Subsequently, process carried out in the recognized data management /display module for medication experiment 16 will be described in accordance with Figs. 7A, 7B and 7C. As shown in Fig. 7A, the CPU 74 initially generates the recognized value display window for medication

experiment 28 (see Fig. 11) (step S41).

【0104】 The vertical scale on the display window for medication experiment 28 is set so as to be an optimal scale corresponding to measurement parameters (cardiograms in this embodiment). The horizontal scale on the display window for medication experiment 28 is set so as to be an optimal time scale for evaluating the effect of medicated medicine. In this embodiment, the time scale is set so that the effect of medicated medicine for a long period of time can be at a glance.

【0105】 Subsequently, the CPU 74 acquires both the recognized value data and the abnormality judgment data the for 1 waveform serving as output of the recognition module 10 (see step S5 in Fog. 4) and distinguishes the kind of the abnormality judgment data (step S43).

【0106】 When the abnormality judgment data indicates "normal", each of the recognition data equivaluent to 1 complete wave is respectively displayed in graphical representation. As shown in Fig. 11, the starting point Pb of P wave, the top point Pa of P wave, the starting point Q of Q wave, the top point R of R wave, the top point S of S wave, the top point Ta of T wave and the ending point Te of T wave are respectively displayed as dark red, khaki, white, red, yellow, light purple and purple on the display window for medication experiment 28.

【0107】 In the display window for medication experiment 28, a time duration RR, a time duration Qt, a time duration PR and so on are respectively displayed on a lower window as red, light blue and gray in graphical representation.

【0108】 Once the display of the recognition data equivaluent to 1 complete wave is completed, the process returns to step S42 and carries out

process of displaying the recognition data for upcoming entire 1 waveform in graphical representation.

[0109] When the abnormality judgment data indicates one of "abnormality in waveform" and "abnormality caused by noises" in step S43, the process returns to step S42 without carrying out the graphical representation of recognition data about a part for 1 waveform which has an abnormal part.

[0110] As shown in Fig. 7B, on the other hand, the CPU 74 monitors the generation of medicine medication event (step S51), and a mark 52 indicating medicine medication is displayed on a position showing medication time in green color on the recognized value display window for medication experiment 28, for example, when the even is generated (step S52). In this embodiment, the process is configured so that a medicine medication event is generated when a foot switch for medicine medication (not shown) is stepped on.

[0111] Thereafter, the CPU 74 calculates values of the recognized data right before the generation of medicine medication event (step S53) and stores the time of generation of the medicine medication event (step S54) and then displays a dialog for inputting the information about medication medicines prescribed, such as a medicine name and the amount of medication (step S55). The operator (experimenter) inputs predetermined information about the prescribed medication medicines in accordance with guidance of the dialog.

[0112] Then, the CPU 74 outputs the values of the recognized data calculated in step S53, and the time of generation of the medicine medication event stored in step S54 (step S56). Then the process returns to step S51

and the CPU 74 waits for upcoming generation of medicine medication event.

【0113】 In this embodiment, the values of the recognized data right before the generation of medicine medication event calculated in step S53 are a value QTc (its formula is represented in QTc= time duration QT/SQRT (time duration RR)) besides the time duration RR, the time duration QT, the time duration PR, the top point Pa of P wave, the top point R of R wave, the top point S of S wave, the top point Ta of T wave, where in SQRT(X) shows square root of X.

【0114】 As shown in Fig. 7C, the CPU 74 further monitors the generation of reactant medicine medication event (step S61), a mark 54 indicating reactant medicine medication is displayed on a position showing medication time in yellow color, for example when the reactant medicine medication event is generated (step S62). And then the process returns to step S61 and the CPU 74 waits for upcoming generation of reactant medicine medication event.

【0115】 In this embodiment, the process is configured so that a reactant medicine medication event is generated when a foot switch for reactant medicine medication (not shown) out of the foot switch 104 is stepped on.

【0116】 Here, the reactant medicine medication event is the act which prescribes for the patient the reactant medicine used in order to check the medication effect of an evaluation medicine. The evaluation medicine is a medicine to which the heart function is changed temporarily. The medication effect of the evaluation medicine over the rise of cardiac beats rate can be known, for example, if the state of the cardiogram, at the time of giving the reactant medicine by which cardiac beats rate still more temporarily increasing after prescribing the evaluation medicine once, is

recognized.

【0117】 Hence, in this embodiment, while extracting the recognition data representing the characteristic of the original waveform data based on the original waveform data, graphical representation of the recognition value data including the past history using a graph having a time-axis, is carried out.

【0118】 Hence, characteristics of the recognition value data can easily be distinguished visually in real time basis. Consequently, the effect of medication to laboratory animals can easily be evaluated visually in real time basis.

【0119】 In addition, this embodiment discriminates and eliminates abnormal part caused by sudden causes such as abnormality in waveform and abnormality caused by noises out of the recognition value data and only displays a graph eliminating the abnormal part caused by a sudden cause.

【0120】 Consequently, the variation of the recognition value data caused by the medication can be visually recognized in more detail by graphically displaying only the recognition value data eliminating the abnormal part caused by sudden causes.

【0121】 In addition, the mark 52 indicating medicine medication and the mark 54 indicating reactant medicine medication are displayed when the variation of the recognition value data is graphically displayed. Consequently, it is convenient to easily recognize in real time basis a relationship between the variation of the recognition value data and the medication of the reactant medicine.

【0122】 Subsequently, process carried out in the recognized data

management /display module for reactant experiment 18 will be described in accordance with Figs. 8A 8B and 8C. As shown in Fig. 8A, the CPU 74 initially generates the recognized value display window for reactant experiment 30 (see Fig. 11) (step S71).

【0123】 The vertical scale on the recognized value display window for reactant experiment 30 is set so as to be an optimal scale corresponding to measurement parameters (cardiograms in this embodiment). The horizontal scale on the recognized value display window for reactant experiment 30 is set so as to be an optimal scale for recognizing the influences caused by the medication of the reactant medicine.

【0124】 In this embodiment, the time scale is set so as to recognize the influences caused by the medication of the reactant medicine which ends in a short period of time (for example in a few minutes) in detail. In other words, the recognized value display window for reactant experiment 30 just enlarges (for example, hundreds times) the horizontal axis of the recognized value display window for medication experiment 28 and display it.

【0125】 In steps S72, S73 and S74 carried out by the recognized data management /display module for reactant experiment 18 shown in Fig. 8A, exactly the same steps to the steps S42, S43 and S44 carried out by the recognized data management /display module for medication experiment 16 shown in Fig. 7A are carried out

【0126】 Similar process such that the process returns to step S72 without carrying out graphical display of the recognition value data for 1 complete waveform having an abnormal part when the abnormality judging data represents one of the "abnormality in waveform" and the "abnormality caused by noises" is carried out in step S73.

【0127】 Subsequently, the CPU 74 calculates the maximum value and the minimum value of the recognition data within a predetermined period from medication of the reactant medicine (step S75), and outputs the values (step S76), and the process returns to step S72.

【0128】 A time period until medication of the subsequent reactant medicine is set as the predetermined period in this embodiment. The predetermined period, however, is not limited to that time period. Such predetermined period can be set to a certain period (for example 1 minute) from the medication of the reactant medicine.

【0129】 As described in the above, the maximum value and the minimum value of the recognition data can be automatically be calculated whenever the reactant medicine is medicated by carrying out the process of calculating both the maximum value and the minimum value of the recognition data using a time period from the medication of the reactant medicine to a predetermined period as a unit. In this way, the effect of an evaluation medicine can easily be recognized on real time in accordance with medication of the reactant medicine carried out one after another.

【0130】 Alternatively, the predetermined period can be ended at any timing. In this way, high reliability statistic data (maximum value and minimum value) can be obtained because the predetermined period can be ended at an optimal timing, for example, while checking the influences of the reactant medicine on the recognized value display window for reactant experiment 30.

【0131】 In addition, the starting time of an object period for calculating the maximum value and the minimum value can be set at predetermined timing. To do that way, it is more preferable for starting the object period at

an optimal timing, for example, while checking the influences of the reactant medicine on the recognized value display window for reactant experiment 30.

【0132】 As shown in Fig. 8B, the CPU 74, on the other hand, monitors the generation of medicine medication event (step S81), and a mark (not shown) indicating medicine medication is displayed on a position showing medication time in green color on the recognized value display window for reactant experiment 30, for example, when the even is generated (step S82). Then the process returns to step S51 and the CPU 74 waits for upcoming generation of medicine medication event.

【0133】 As shown in Fig. 8C, the CPU 74 further monitors the generation of reactant medicine medication event (step S91), the generating time of the event is made into the starting point of a horizontal axis, and the variation of the recognition data thereafter is graphically displayed when the reactant medicine medication event is generated (step S92).

【0134】 Thereafter, the CPU 74 calculates values of the recognized data right before the generation of reactant medicine medication event (step S93) and stores the time of generation of the reactant medicine medication event (step S94) and then displays a dialog (not shown) for inputting the information about reactant medicines prescribed, such as a medicine name and the amount of medication (step S95). The operator (experimenter) inputs predetermined information about the prescribed medication medicines in accordance with guidance of the dialog.

【0135】 Then, the CPU 74 outputs the values of the recognized data calculated in step S93, and the time of generation of the reactant medicine medication event stored in step S94 (step 96). Then the process returns to step S91 and the CPU 74 waits for upcoming generation of reactant medicine

medication event.

【0136】 In this embodiment, the values of the recognized data right before the generation of reactant medicine medication event calculated in step S93 are the time duration RR, the time duration QT, the time duration PR, the top point Pa of P wave, the top point R of R wave, the top point S of S wave, the top point Ta of T wave and the value QTc and so on similar to the case of the recognized data management /display module for medication experiment 16.

【0137】 As described in the above, in this embodiment, the recognized value display window for reactant experiment 30 just enlarges the horizontal axis of the recognized value display window for medication experiment 28 and display it, similar to the display 28.

【0138】 In this way, graphic display can be carried out using scales of respective optimal time-axis of both the influences affect on laboratory animals medicating the evaluation medicine by which a reaction continues over comparatively long time and the influences of the medicated reactive medicine by which a reaction disappears in comparatively short time. Consequently, the timing for the upcoming medication of the reactive medicine can be determined easily.

【0139】 Subsequently, process carried out in the digital data display module 20 will be described in accordance with Fig.9 and Fig. 14 enlarging the display images 24 on the digital display window 34. Initially the CPU 74 displays a measurement mode set according to an animal database (step S101). Such measurement mode is displays on a measurement mode display area 40 of the digital display window 34.

【0140】 The CPU 74 monitors events automatically generated in every

second within the computer (step S102), displays a measurement time period from the measurement start when evens are generated every second (step S103), a remaining measurement time when the end time is fixed (step S104), measurement conditions (step S105), a lapsed time post-medication of the evaluation medicine (step S106), a lapsed time post-medication of the reactant medicine (step S107) and an average value for 1 second of the current measurement value data (measurement data) (step S108)。

【014 1 】 The measurement time period, the remaining measurement time (remaining time period) and the measurement conditions are displayed on a measurement time period display area 42 on the digital display window 34. The lapsed time post-medication of the evaluation medicine (time period post-medication of medicine) and the lapsed time post-medication of the reactant medicine (time period post-reaction) are displayed on a time period post-medication display area 44 on the digital display window 34. The current average value (current value) for 1 second of the current measurement value data (measurement data) is displayed on a current value display area 46 of the digital data display window 34.

【0142】 The CPU 74, on the other hand, judges whether or not input of the medicine medication event (step S109) , and acquires a pre-medication value (a value just before the medicine medication event is generated based on each recognition value data) output by the recognized data management /display module for medication experiment 16 and the medication time (the time when the medication event is generated) (see Fig. 7B, step S56) (step S110), and then, displays the acquired pre-medication value (step S111). Such acquired pre-medication value is displayed on a pre-value display 48 of the digital data display window 34.

【0143】 Thereafter, the CPU 74 resets the lapsed time post-medication of the evaluation medicine (time period post-medication of medicine). By resetting the time period post-medication, a lapsed time post-medication of the evaluation medicine using a current medicine medication event as the starting point thereof is displayed on the time period post-medication display area 44 on the digital display window 34.

【0144】 Then, the CPU 74 judges whether or not the medicine medication event is input (step S113). The process proceeds to step S113 even when no input the medicine medication event is carried out in step S109.

【0145】 When the medicine medication event is input in step S113, a pre-reactant medicine medication value (a value right before the generation of the reactant medicine medication event) output by the recognized data management /display module for reactant experiment 18 and medication time the time of generation of the reactant medicine medication event stored) (see Fig. 8C, step S96) are acquired (step S114), and the pre- medication value of reactant medicine thus acquired is displayed (step S115). Such values are displayed on the pre-value display 48 of the digital data display window 34. In this way, either of the pre-medication value or the pre-reactant medicine medication value is displayed on the pre-value display 48.

【0146】 Then, the CPU 74 resets the lapsed time period post- medication of reactant medicine (time period post-reaction). By resetting the time period post-reaction, a lapsed time post-medication of the reactant medicine using a current reactant medicine medication event as the starting point thereof is displayed on the time period post-medication display area 44 in the digital display window 34.

【0147】 Then, the CPU 74 judges whether or not either of the maximum value or the minimum value of the recognition value data is input within a predetermined period after the medication of the reactant medicine (step S117). The process proceeds to step S117 even when no input of reactant medicine medication event is carried out in step S113.

【0148】 When the maximum value or the minimum value of the recognition value data is input in step S117, the maximum value or the minimum value output by the recognized data management /display module for reactant experiment 18 are acquired (step S118), and the values thus acquired are displayed (step S119).

【0149】 The maximum value or the minimum value are displayed on a maximum value so on display area 50 in the digital display window 34. A shown in Fig. 14, both the maximum and the minimum values of representing recognition value data (in this embodiment, a time duration RR) including the past data are displayed on the display area 50.

【0150】 Each line on the display area 50, the number of reactant medicine medication [(01) so on], representing recognition value before the medication [Bf: 356 so on] of besides the maximum value[Max:393 and so on] and the minimum value [Min: 307 and so on], various values varying from the representing recognition value before the medication to the maximum value and the minimum value [Δ+ 37, Δ- 49 and so on] and lapsed time period from the medication to the period causing the maximum value and the minimum value [Tm101s, Tm6s and so on] are displayed.

【0151】 Once all the displays of the display area 50 are completed, the process proceeds to step 102. The process proceeds to step S102 even when there are no information on the maximum value and the minimum value in

step S117.

【0152】 As described in the above, the maximum value and the minimum value of the representing recognition value and related value(s) thereof are displayed real time whenever the reactant medicine medication event is generated in this embodiment.

【0153】 Consequently, heart function of laboratory animal(s) can easily be recognized real time by displaying the maximum value and the minimum value of the representing recognition value directly indicating variation of the electrocardiogram caused by the effect of the reactant medicine.

【0154】 In addition, the maximum value and the minimum value of the representing recognition value and the related amount thereof including the past data are displayed. In this way, result of the reactant medicine medication in the past which is not displayed on the recognized value display window 30 can be recognized real time as well.

【0155】 As also described in the above, experimental conditions and circumstances, such as a measurement mode, a measuring period from the start measurement, a remaining measurement time, measurement conditions, a lapsed time post-medication of the reactant medicine, a current recognition value data, a pre-medication value and a pre-reactant medicine medication value.

【0156】 In this way, the conditions easily can be recognized real time. Consequently, experimental circumstances including the situation of laboratory animals can easily be recognized real time.

【0157】 In addition, the maximum value and the minimum value are displayed only for the time duration RR as a representing recognition value out of the recognition value data in this embodiment. However, the

representing recognition value representing the maximum value and the minimum value is not limited to the time duration RR. The maximum value and the minimum value may be displayed by using a value QTc as the representing recognition value. In addition, the maximum value and the minimum value may also be displayed respectively for each of the representing recognition values using several kinds of recognition value data as the representing recognition values.

【0158】 Both the maximum value and the minimum value of the recognition value data are displayed in this embodiment. Alternatively, one of the maximum value and the minimum value may be displayed. Other statistical amounts appropriate for the recognition value data such as average values and distributed values can also be displayed beside the maximum value and the minimum value of the recognition value data

【0159】 Subsequently, process carried out in the recognized data preservation module 22 will be described in accordance with in accordance with Fig. 10. The CPU 74 acquires both the recognition value data and the abnormality judgment data for 1 complete waveform as the output of the recognition module 10 (see Fig. 4, step S5) and the abnormality judgment data (step S121), and saves these data in the recognized value preservation area within the cardiogram preservation area set into the hard disk 90 (step S122). The CPU 74 repeats the steps S121 and S122, and records the recognition value data for each of 1 complete waveforms for all the waveforms.

【0160】 [3. Other embodiments] Although, an exemplary embodiment in which each of the functions performed by the display device 70 is realized with the CPU 74 is described herein, partial or the entire function(s) of the

display device 70 can be realized hardware logic circuitries.

[0161] In the above described embodiment, a cardiogram is used as one of the measurement parameters, the present invention may also be applicable to the cases in which the measurement parameters are other circulatory system such as blood pressure, blood current, left ventricular pressure and so on, respiratory system such as respiratory volume, and digestive system.

[0162] This invention is not limited to the case in which one measurement parameter is measured for the one laboratory animal 106. The present invention can also be applicable to the cases for example, in which one measurement parameter is measured simultaneously for two or more laboratory animals of a different kind or of the same kind and a plurality of measurement parameters are measured simultaneously for one laboratory animal. In addition, the present invention may also be applicable to the case in which different kinds of plural measurement parameters are measured simultaneously for two or more laboratory animals of a different kind or of the same kind.

[0163] The present invention is applicable not only to the case in which a measurement parameter(s) is measured on laboratory animals but also the case in which a measurement parameter(s) representing its condition is measured on any kind of living body including human being. The present invention can further be applicable when displaying based on the amount data of states corresponding to the state where it does not come to see to a living body, but can express as a function of time, such as a weather state and economic conditions.

[Advantages of the present invention]

[Brief description of the drawings]

【Fig. 1】

FIG. 1 is an exemplary diagram of a display device 70 of quantity of state according to the present invention.

【Fig. 2】

FIG. 2 is a diagram illustrating hardware structure of the display device 70 shown in Fig. 1 when its functions realized by the CPU 74.

【Fig. 3】

FIG. 3 is a diagram illustrating hardware structure of the display device 70 shown in Fig. 1 when its functions realized by the CPU 74.

【Fig. 4】 FIG. 4 is a flow chart showing the process carried out by the recognition module 10.

【Fig. 5】 Fig. 5 is a flowchart showing the process carried out by the original waveform preservation module 12.

【Fig. 6】 Figs. 6A and 6B are a flowchart showing the process carried out by the original waveform display module 14.

【Fig. 7】 Figs. 7A, 7B and 7C are a flowchart showing the process carried out by the recognized data management /display module for medication experiment 16.

【Fig. 8】 Figs. 8A, 8B and 8C are a flowchart showing the process carried out by the recognized data management /display module for reactant experiment 18.

【Fig. 9】 Fig. 9 is a flowchart illustrating process carried out in the digital data display module 20.

【Fig. 10】 Fig. 10 is a flowchart illustrating process carried out in the recognized data preservation module 22.

【Fig. 11】 Fig. 11 is a view showing the display images 24 of the display

82.

【Fig. 12】 Fig. 12 is a partial enlarged view of the original waveforms display window 32. of the display images 24.

【Fig. 13】 Fig. 13 is a further partial enlarged view of the original waveforms display window 32 shown in Fig. 12.

【Fig. 14】Fig. 14 is an enlarged view of the digital data display window 34 of the display images 24.

【Fig.15】 Fig. 15 is a partial enlarged view of the recognized value display window for medication experiment 28 of the display images 24.

【Fig. 16】 Fig. 16 is a partial enlarged view of the recognized value display window for reactant experiment 30 of the display images 24.

【Description of the reference numerals】

32・・・・original waveforms display window

36・・・・top point of R wave of abnormal original waveform

38・・・top point 38 of R wave of abnormal original waveform caused by noises

R・・・・top point of R wave of normal original waveform

[Abstract]

【Object】 It is an object of the present invention to provide a display device of quantity of state and a method of displaying quantity of state can recognize the object to be monitored easily and correctly on real time.

【Means to achieve the object】 During the display of an original waveform, when the original waveform is judged as normal, the top point R of the R wave of the original waveform is displayed in red (the color shows normality). When the original waveform is an abnormal waveform, the top point 36 of R wave of the abnormal original waveform is displayed in yellow (the color illustrates abnormality). When the original waveform is an abnormal waveform by noises, the top point 38 of R wave of the abnormal original waveform is displayed in white (the color illustrates abnormality caused by noises). The abnormality caused by noises and the abnormality in waveform can easily be distinguished visually in real time basis. Consequently, the difference between noises caused by movement of living body such as laboratory animals and the abnormality in waveform can easily be distinguished visually in real time basis.

Fig.1

2: state quantity data acquiring means

4: control means

6: display means

10: living body

Fig.2

82: display

84: keyboard

86: mouse

104: foot switch

102: cardiograph sensor

106: laboratory animal

Fig.3

10: recognition module

12: original waveform preservation module

14: original waveform display module

16: recognized data management / display module for medication experiment

18: recognized data management / display module for reactant experiment

20: digital data display module

22: recognized data preservation module

Fig.4

S1: input original waveform data

S2: 1 complete waveform is input?

S3: wave recognition

S4: judge abnormality

S5: output recognized value data, abnormality judgment data

Fig.10

S121: input recognized data, abnormality judgment data

S122: save recognized data and abnormality data input in recognized value preservation area within

Fig.5

original waveform preservation command event

S11: wait for original waveform preservation command event

S12: input original waveform data

S13: save original waveform data into preservation area corresponding to current number of command of original waveform preservation area in currently measurement channel storage area

S14: input recognized value data, abnormality judgment data

S15: save recognized value data and abnormality judgment data into preservation area corresponding to current number of command of original waveform preservation area in currently measurement channel storage area

YES NO

S16: original waveform preservation period has passed?

Fig.6

A

S21: generate original waveforms display window

vertical axis: measurement range depending on measurement parameter

horizontal axis: setup time of original waveform display

S22: input original waveform data

S23: display original waveform

B

S31: input recognized value data, abnormality judgment data

S32: abnormality data

abnormality caused by noises

normal

abnormal waveform

S33: display judgment value in color representing noise abnormality so that showing original waveform

S34: display judgment value in color representing waveform abnormality so that showing original waveform

S35: display judgment value in color representing normal so that showing original waveform

Fig.7

A

S41: generate recognized value display window for medication experiment

vertical axis: measurement range depending on measurement parameter

horizontal axis: setup time of medication experiment display

S42: input recognized valued data, abnormality judgment data

S43: abnormality data

abnormality caused by noises

normal

S44: display recognition data

B

medicine medication event

S51: wait for medicine medication

S52: display medicine medication event mark on position showing medication time on display window

S53: calculate value before medicine medication

S54: store time of generating medication event

S55: display dialog for inputting information on medication

S56: output calculated value before medication and time of generating event

C

reactant medicine medication event

S61: wait for reactant medicine medication event

S62: display reactant medicine medication event mark on position showing medication time on display window

Fig.8

A

S71: generate recognized value display window for reactant medication experiment

vertical axis: measurement range depending on measurement parameter

horizontal axis: setup time of reactant medication experiment display

S72: input recognized value data, abnormality judgment data

S73: abnormality data

abnormality caused by noises

normal

S74: display recognition data

S75: calculate maximum minimum value during reactive experiment

S76: output maximum, minimum value

B

medicine medication event

S81: wait for medicine medication

S82: display medicine medication event mark on position showing medication time on display window

C

reactant medicine medication event

S91: wait for reactant medicine medication event

S92: clear display window, generating time of event is made into minimum value of horizontal axis, and graphically display data

S93: calculate value before medicine medication

S94: store time of generating medication event

S95: display dialog for inputting information on reactant medication

Fig.9

S101: display measurement mode set according to animal database

every second event

S102: every second

S103: display measurement period from start

S104: display remaining period when end time is fixed

S105: display measurement conditions

S106: display lapsed time post-medication of evaluation

S107: display lapsed time post-medication of reactant

S108: display average value for 1 second of current measurement value data

YES NO

S109: medicine medication event input information?

S110: input pre-medication value

S111: display acquired pre-medication value

S112: reset lapsed time post-medication

YES NO

S113: reactant medicine event input information?

S114: input pre-medication value of reactant

S115: display pre-medication value for reactant medicine

S116: reset lapsed time post-reaction

YES NO

S117: maximum or minimum value input after reactant medication

S118: acquire maximum or minimum value for reactant experiment

S119: display maximum and minimum value acquired

Fig.12

32: original waveforms display window

36: top point of R wave of abnormal original waveform

38: top point 38 of R wave of abnormal original waveform caused by noises

R: top point of R wave of normal original waveform

Fig.14

40 measurement mode: manual start automatic-termination measuring period

42 measuring period remaining time under measurement

44 post-medication period post-reaction period

unit

43 current value

Fig.15

reaction experiment (Upper Lower) (min.)

Fig.16

reaction experiment (Upper Lower) (min.)